A NEW SPECIES OF *CHUSQUEA* SECT. *VERTICILLATAE* (POACEAE: BAMBUSOIDEAE) FROM ECUADOR

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ABSTRACT

Chusquea annagardneriae, a species of *Chusquea* sect. *Verticillatae* from Ecuador, is described as new. It is illustrated and compared and contrasted with *Chusquea albilanata*, the species to which it is most similar. *Chusquea annagardneriae* is distinguished from all other species of *Chusquea* by its auriculate foliage leaf blades, but it is also characterized by tuberculate internodes, more or less pseudopetiolate culm leaf blades, the presence of fibrillar branchlets in the branch complement, an open pyramidal synflorescence, dorsally compressed spikelets with glumes I and II both greatly reduced and scalelike, and glumes III and IV extending about half of the spikelet length. *Chusquea annagardneriae* is endemic to the province of Loja, Ecuador, and occurs in dry forest scrub and forest remnants at 2000 to 2250 m in elevation.

RESUMEN

Se describe **Chusquea annagardneriae,** una especie nueva de Ecuador que pertenece a *Chusquea* sección *Verticillatae*. *Chusquea annagardneriae* se ilustra y se compara con *C. albilanata*, la especie más parecida. Se distingue *Chusquea annagardneriae* de todas las otras especies del género por sus láminas foliares auriculadas, pero se le distingue además por sus entrenudos tuberculados, lámina de la hoja caulinar más o menos pseudopeciolada, la presencia de ramitas fibrilares en el complemento de ramas, una sinflorescencia abierta y piramidal, espiguillas comprimidas dorsalmente con glumas I y II fuertemente reducidas y escamosas, y glumas III y IV extendiéndose por la mitad de la longitud de la espiguilla. *Chusquea annagardneriae* es endémica a la provincia de Loja, Ecuador, y ocurre en vegetación secundaria de bosque seco y en restos de bosque a 2000 a 2250 m.s.n.m.

INTRODUCTION

The native bamboo diversity of Ecuador is considerable and includes seven genera of woody bamboos (Bambuseae) and six genera of herbaceous bamboos (Olyreae). Among the woody bamboos of Ecuador, *Chusquea* Kunth is the most diverse genus, with an estimated 30 species, of which several are undescribed. In this paper we describe and illustrate *Chusquea annagardneriae*, one of the Ecuadorian species new to science.

The 30 or so species of *Chusquea* in Ecuador fall into either *Chusquea* subg. *Swallenochloa* (McClure) L.G. Clark or *Chusquea* subg. *Chusquea*. The latter subgenus is subdivided into five sections and a few informal groups, with representatives of all five of the formally recognized sections known from Ecuador. This new species clearly belongs to sect. *Verticillatae*, based on its relatively thin foliage leaf blades, more or less dorsally compressed spikelets, and extremely reduced glumes I and II (Clark 1989). *Chusquea annagardneriae* joins *C. albilanata* L.G. Clark, *C. perligulata* (Pilger) McClure, *C. simpliciflora* Munro, and *C. uniflora* Steud., the other members of this section in Ecuador. The new species most closely resembles *C. albilanata*, with which it is compared and contrasted.

Interestingly enough, the first collections of this species were made only in 1989, and the remaining collections were made in 1996. Fortunately, both vegetative and flowering specimens are available so that we have a relatively complete picture of the species, but it does appear to be uncommon. This area of Ecuador, however, seems to be less well explored botanically so *Chusquea annagardneriae* may be more widespread than currently available collections suggest.

TAXONOMIC TREATMENT

Chusquea annagardneriae L.G. Clark, C.D. Tyrrell, Triplett & A.E. Fisher, sp. nov. (**Fig. 1**). TYPE: ECUADOR. LOJA: road Velacruz-Catacocha, ca. km 6, 2040 m, ca. 4°S, 79°35'W, 11 Mar 1989 (fl), *B. Øllgaard, L. Ellemann & B. Eriksen 90959* (HOLOTYPE: QCA!; ISOTYPE: AAU!).

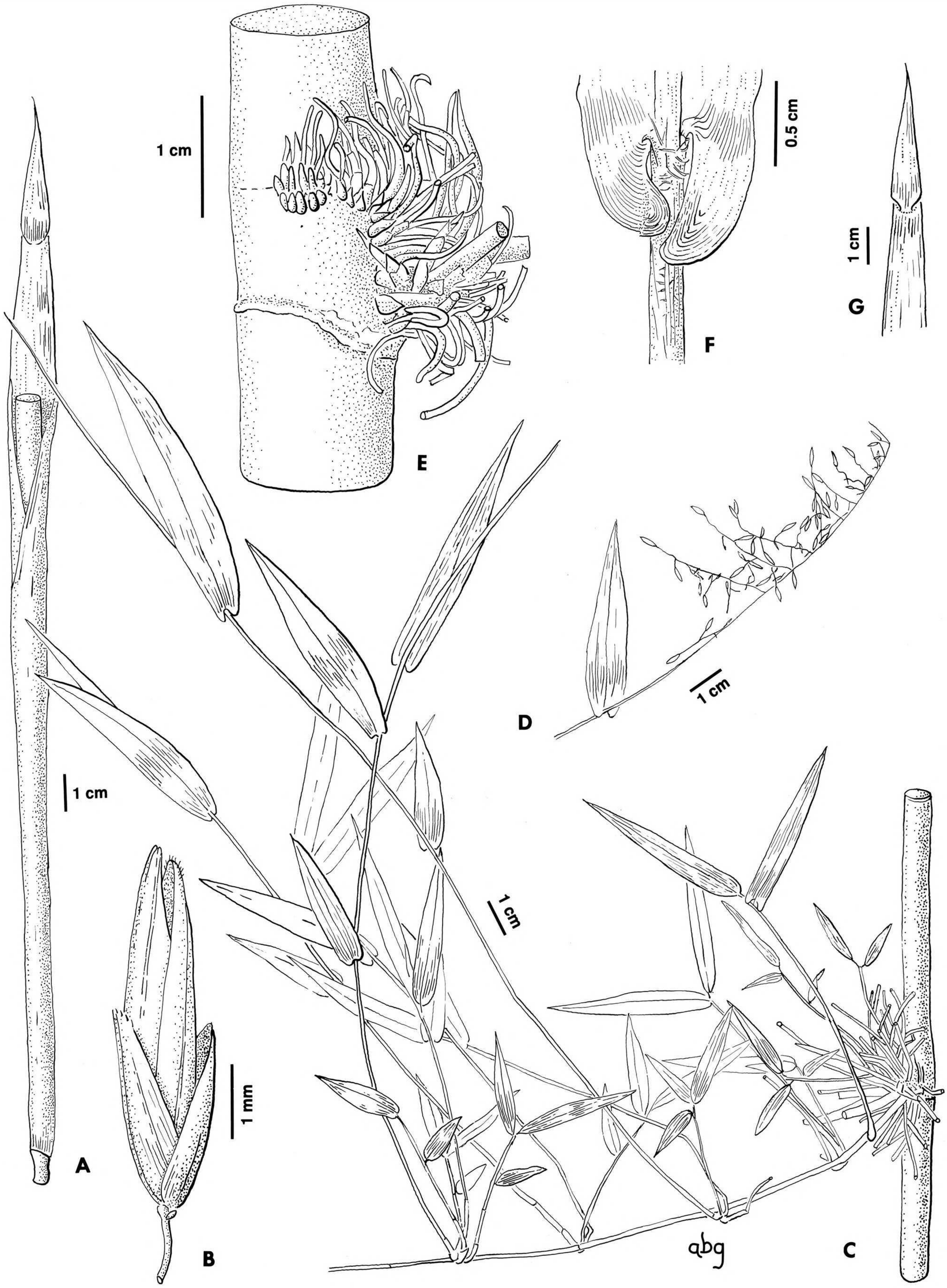

FIG. 1. *Chusquea annagardneriae*. **A.** Culm leaf attached to the culm. **B.** Spikelet. **C.** Branch complement showing one of the more robust leafy, rebranching subsidiary branches. **D.** Synflorescence. **E.** Detail of branch complement base, showing fibrillar branchlets and two sizes of subsidiary branches. **F.** Auriculate foliage leaf base and ciliate overlapping sheath margin. **G.** Detail of culm leaf apex showing pseudopetiolate blade, abaxial view. (A, C, E-G based on *Clark & Asimbaya 1437*; B, D based on *Øllgaard et al. 90959*).

Culmi 2.5–4 m alti, 0.5–1.1 cm diametro, scandentes; internodia 20–32 cm longa, glabra, tuberculata. Folia culmorum 24.5–28 cm longa, ut videtur persistentia; vaginae 22–25 cm longae, 6–10–plo longior quam laminam, adaxialiter antrorsum scabrido-pubescentes in quarta parte superiore, abaxialiter glabrae, tessellatae pro parte maxima; cingulum 0.2–1 mm latum, pubescens; laminae 2.2–4 cm longae, erectae, lanceolatae, plus minusve pseudopetiolatae, adaxialiter antrorsum scabridae, abaxialiter glabrae. Ramificatio extravaginalis; rami subsidiarii numerosi, dimorphi, ramulis fibrillosis crispis. Folia cujusquisque complementi 3–5; vaginae glabrae vel pilosae, maculatae; laminae 2.9–8.5 cm longae, 0.4–1.3 cm latae, ratio long.:lat. 5–8.5, lanceolatae, adaxialiter glabrae, abaxialiter glabrae, non tessellatae vel interdum infirmissimus tessellatae, basibus auriculatis interdum cordatis. Synflorescentia 3–9 cm longa, aperta, pyramidalis; rami primarii infimi 1.5–4.5 cm longi. Spiculae 5–5.7 mm longae, dorsaliter compressae; glumae I et II squamiformes, minimae; glumae III et IV plerumque ad dimidium longitudem spiculae, acutae, plerumque breviter mucronatae; lemma 4.6–5 mm longum, subacutum vel breviter mucronatum.

Woody bamboo. **Culms** 2.5–4 m tall, 0.5–1.1 cm diam., scandent; **internodes** 20–32 cm long, tuberculate, more or less terete, glabrous, a narrow band of pubescence often present just below the nodes in new shoots, but absent from the mature internodes. **Culm leaves** 24.5–28 cm long (only two complete examples seen), apparently persistent, juncture of the sheath and blade more or less horizontal; **sheaths** 22–25 cm long, 6–10 times as long as the blade, adaxially antrorsely scabrid-pubescent for at least the upper one-fourth, abaxially glabrous, tessellate on the upper two-thirds, margins free, at least the overlapping one ciliate toward the summit; **girdle** 0.2–1 mm wide, pubescent; **inner ligule** ca. 2 mm long, dark brown, abaxially pubescent, ciliate; **outer ligule** sometimes visible as a ciliolate rim to 0.5 mm long; **blades** 2.2–4 cm long, erect, lanceolate, adaxially antrorsely scabrid, abaxially glabrous, base rounded, narrower than the sheath summit and thus more or less pseudopetiolate, apex subulate. **Nodes** at mid-culm with one triangular central bud subtended by 40–50 subsidiary buds in several rows in a U-shaped crescent, nearly surrounding the central bud; **nodal line** dipping slightly below the bud/branch complement; **supranodal ridge** more or less pronounced. **Branching** extravaginal; **subsidiary branches** numerous, of two sizes, usually two larger and rebranching, the several to many smaller subsidiary branches developing into short, curly fibrillar branchlets or longer leaf branches. **Foliage leaves** 3–5 per complement; **sheaths** glabrous or pilose, mottled, only weakly keeled toward the apex, the overlapping margin and summit ciliate; **outer ligule** a minute ciliolate or ciliate rim 0.1–0.2 mm long; **inner ligule** 0.5-0.8 mm long, truncate to rounded or slanted, margin ciliate; **pseudopetiole** 0.5–1 mm long, distinct, glabrous; **blades** 2.9–8.5 cm long, 0.4–1.3 cm wide, L:W = 5–8.5, lanceolate, adaxially glabrous, abaxially glabrous, not tessellate or occasionally very weakly tessellate in patches, midrib centric, margins glabrous to finely serrulate, base usually auriculate, sometimes cordate, apex acuminate-subulate. **Synflorescences** 3–9 cm long, open, pyramidal, well exserted from the subtending sheath; **rachis** flattened toward the base, becoming angular toward the apex, scabrous-pubescent; **branches** flattened to angular, pubescent, the primary ones strongly spreading to slightly reflexed, pulvinate at the base, the pulvinus area tomentose to villous, the lowermost primary branches 1.5–4.5 cm long, the secondary branches and pedicels also spreading; **pedicels** 1–3 mm long, angular, scabrid-pubescent, often sinuous. **Spikelets** 5–5.7 mm long, dorsally compressed; **glumes I and II** scalelike, no more than 1/25 the spikelet length, obtuse, glabrous, nerveless, glume I ca. 0.1 mm long, glume II ca. 0.2 mm long; **glumes III and IV** usually about ½ the spikelet length, triangular, acute, usually shortly mucronate, margins ciliolate apically, glume III 2–3 mm long, 3-nerved, glume IV 2.2–3.3 mm long, 3- or 5-nerved; **lemma** 4.6–5 mm long, navicular, subacute to shortly mucronate, pubescent toward the apex; **palea** 4.6–5.1 mm long, bimucronate, 2-keeled, sulcate only toward the apex, 4- or 6-nerved, sulcus pubescent toward the apex. **Stamens** 3; anthers ca. 2.7 mm long. **Lodicules** 3, the anterior pair 1–1.2 mm long, asymmetrical, ciliate, the posterior one ca. 0.9 mm long, symmetrical, ciliate. **Fruit** unknown.

Etymology.—Chusquea annagardneriae is named for our friend and colleague Anna B. Gardner (1958-2006) in honor of her contributions to agrostology, particularly to the Grasses of Iowa project (Grasses of Iowa 2004) and to bamboo illustration, in the form of both line drawings and website development (Bamboo Biodiversity 2005).

This species is easily distinguished from any other *Chusquea* by its auriculate foliage leaf blades (Fig. 1F). It is also characterized by its more or less pseudopetiolate culm leaf blades, presence of fibrillar branchlets, subsidiary branches of two sizes, and its delicate open synflorescences that bear relatively small, dorsally

Table 1. Morphological comparison of *Chusquea annagardneriae* and *C. albilanata*.

Character	*C. annagardneriae*	*C. albilanata*
Culm diameter (cm)	0.5–1.1	1–1.5
Culm height (m)	2.5–4	3–5
Internode pubescence	glabrous	band of white, woolly pubescence 0.2–1 cm wide just below the nodal lines
Culm leaf blade length (cm)	2.2–4	3–7.4
Culm leaf sheath: blade ratio	6–10	1.7–5.5
Foliage leaf blade length (cm)	2.9–8.5	8–17 (–22)
Foliage leaf blade width (cm)	0.4–1.3	1.8–3.7 (–4.6)
Foliage leaf blade base	auriculate to rarely cordate	rounded to cordate-rounded
Foliage leaf sheath pubescence	overlapping margin and summit ciliate	glabrous
Synflorescence length (cm)	3–9	11–15
Lowermost branch length (cm)	1.5–4.5	7–9
Habitat	secondary dry forest scrub and remnant forest patches	montane forests, secondary vegetation
Distribution	s. Ecuador	c. and n. Ecuador, Colombia

compressed spikelets. Another unusual feature is the presence of an outer ligule in at least some of the culm leaves, but since so few complete examples were seen, it is not clear how consistent this character might be.

This species is known from only five collections from the province of Loja in southern Ecuador, where it persists in secondary scrub from *bosque seco* (dry forest), around pastures and on rocky slopes, and at the edges of forest remnants at elevations of 2000 to 2250 m. Based on current knowledge, *C. annagardneriae* is endemic to Loja, of restricted distribution, and uncommon if not rare. It may, however, be more widely distributed in Loja and neighboring El Oro province, and could perhaps be expected in northern Peru.

Among the Ecuadorian Chusqueas, *C. annagardneriae* is one of three species with fibrillar branchlets present in the branch complement (Fig. 1E); *Chusquea lehmannii* Pilger and *C. albilanata* are the other two. A fourth species, *Chusquea scabra* Soderstr. & C. Calderón from Costa Rica, also has fibrillar branchlets that are caused by an ascomycetous fungus (Soderstrom & Calderón 1978) and we presume that this is true for the three other species as well. Despite the presence of fibrillar branchlets, these species do not appear to be closely related except for the presumed sister relationship between *C. annagardneriae* and *C. albilanata*.

Among the species of *Chusquea* sect. *Verticillatae* in Ecuador, *C. annagardneriae* and *C. albilanata* share tuberculate internodes, the presence of fibrillar branchlets in the branch complements, open pyramidal synflorescences bearing small delicate spikelets, and spikelets with glumes III and IV about half the spikelet length. Besides the distinctive auriculate foliage leaf bases of *C. annagardneriae*, the two species differ in several features summarized in Table 1. Most notably, mature internodes in *C. albilanata* retain a band of hair just below the nodal line and the foliage leaf blades are larger. The synflorescences of *C. albilanata* are also larger overall and the lowermost branches are longer than those of *C. annagardneriae*.

The two 1989 collections were made from flowering plants and one of the 1996 collections (*Clark & Asimbaya 143*) was also made from a flowering plant, although the synflorescences were not mature. The other two 1996 collections, which were from the same area, were completely vegetative. This suggests that either *C. annagardneriae* has a short flowering cycle of approximately seven years, with one population simply not flowering yet (or perhaps out of synchrony with the others) or this species is a sporadic bloomer.

Additional specimens examined. **ECUADOR. Loja:** 7.7 km SE of Velacruz and 11.3 km NE of Catacocha, 2150 m, 4°01'S, 79°32'W, 12 Feb 1996 (fl), *L. Clark & P. Asimbaya 1436* (AAU, ISC, LOJA, MO, Q, QAP, QCA, QCNE, US); 2 km SW of Velacruz on the road to Catacocha, 2170 m, 3°59'S, 79°35'W, 12 Feb 1996, *L. Clark & P. Asimbaya 1437* (AAU, ISC, LOJA, MO, Q, QAP, QCA, QCNE, US); ca. 5 km E of Velacruz, road Velacruz-Catamayo, 2250 m, 3°58'S, 79°32'W, 12 Feb 1996, *L. Clark & P. Asimbaya 1438* (AAU, ISC, LOJA, QCA, QCNE, US); carretero Velacruz-Olmedo, Km 18, 2050 m, 3°55-59'S, 79°34-38'W, 11 Mar 1989 (fl), *A. Freire Fierro 1270* (QCA).

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